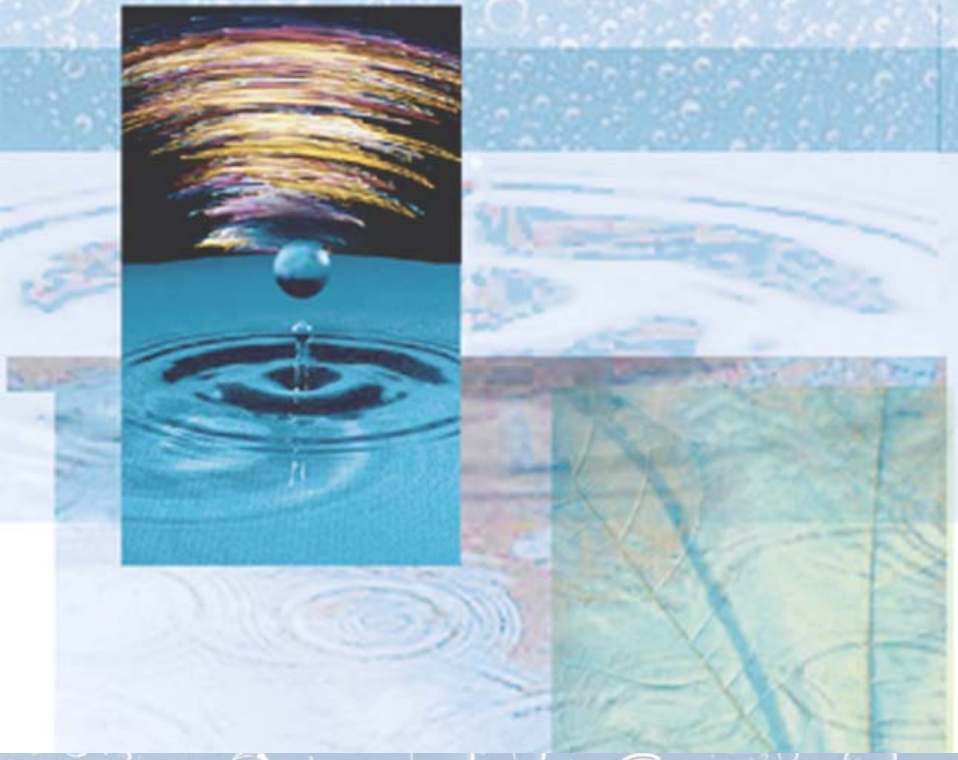
Water and Energy Technologies for Sustainability



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Presentation to LERDWG
Washington, D.C.
February 27, 2003

Water and energy are interdependent

- 12 % of U.S. electricity supply is from hydropower
- 3 % of U.S. electricity is consumed in supplying, moving, pumping and treating water
  - —85% of California's electricity for agriculture is for pumping water and irrigation.
  - —Pumping accounts for nearly 20% of the world's electrical energy demand.

- **Saving water saves energy**: significant opportunities exist for simultaneously increasing efficiencies for water and energy **Saving energy saves water**

LBNL Water Energy Team

Interdivisional and Interdisciplinary:

(Environmental Energy Technologies and Earth Sciences Divisions)

- **Water and Energy Technology and Analysis**
  - **Economists (Life Cycle Costs, Regional/National Impacts)**
  - **Water and Energy Efficiency Technology, Market and Policy Researchers**
- **Hydrology, Ecology, Hydrochemistry & Hydroclimate**
  - **Hydrologists**
  - **Climate & Groundwater Modelers**
  - **Water Quality Experts (Chemistry & Microbiology)**
  - **Water & Wastewater Treatment Researchers**
  - **Well Testing & Watershed Characterization**

LBNL Water Research Structure

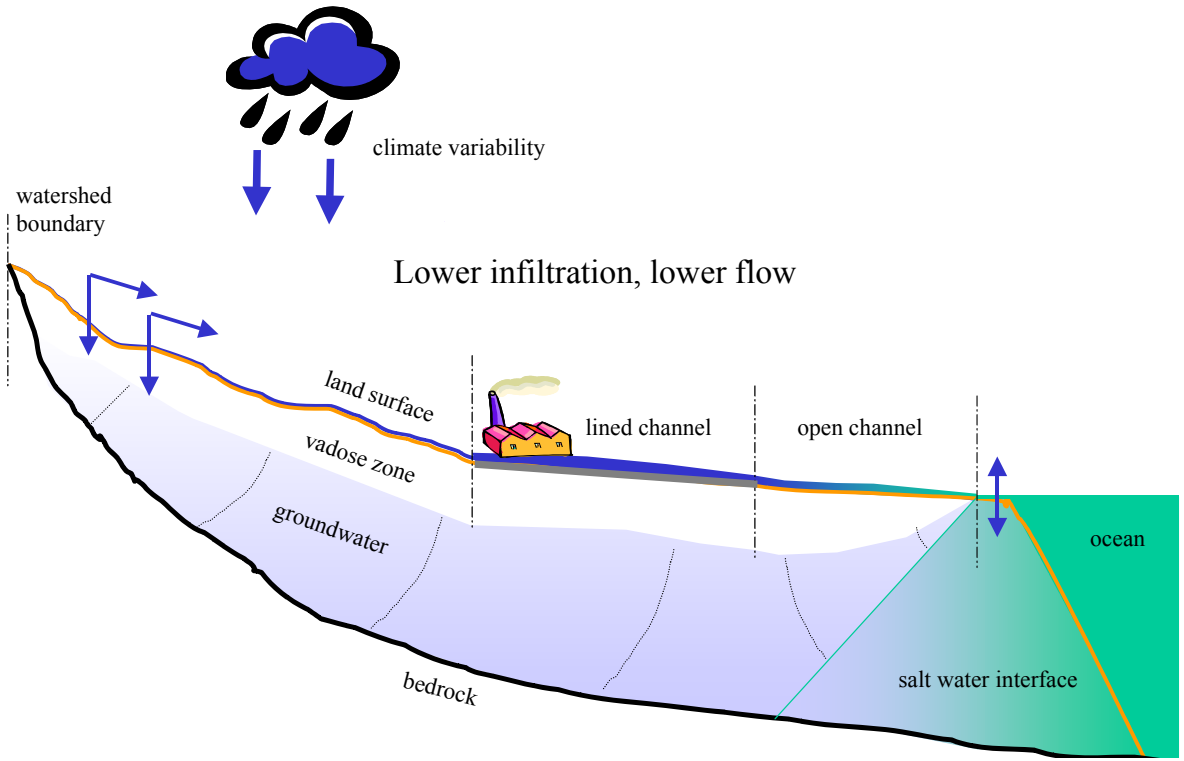
To achieve sustainability through efficient technologies and integrated management of water and energy resources

- **Water Availability**
  - — **Global & Regional Climate Monitoring & Modeling**
- **Water Quality**
  - — **Watershed Level Water Quality Management**

- **Water and Energy Conservation & Use Efficiency**
  - — **Water & Energy Data, Efficient Technologies, and Analysis**
- **Air Quality**
  - — **Atmospheric processes; Technology, modeling & climate change studies**
- **Water Disaster & Security**
  - — **Modeling, Impact Assessment & Technology Development**

Water Availability

- **Global & Regional Climate Change Modeling**
- **Remotely Sensed Data for Seasonal and Long-Term Predictions of Water Resources**
- **Modeling and Analysis of the Hydrologic Cycle**



Water Quality Research

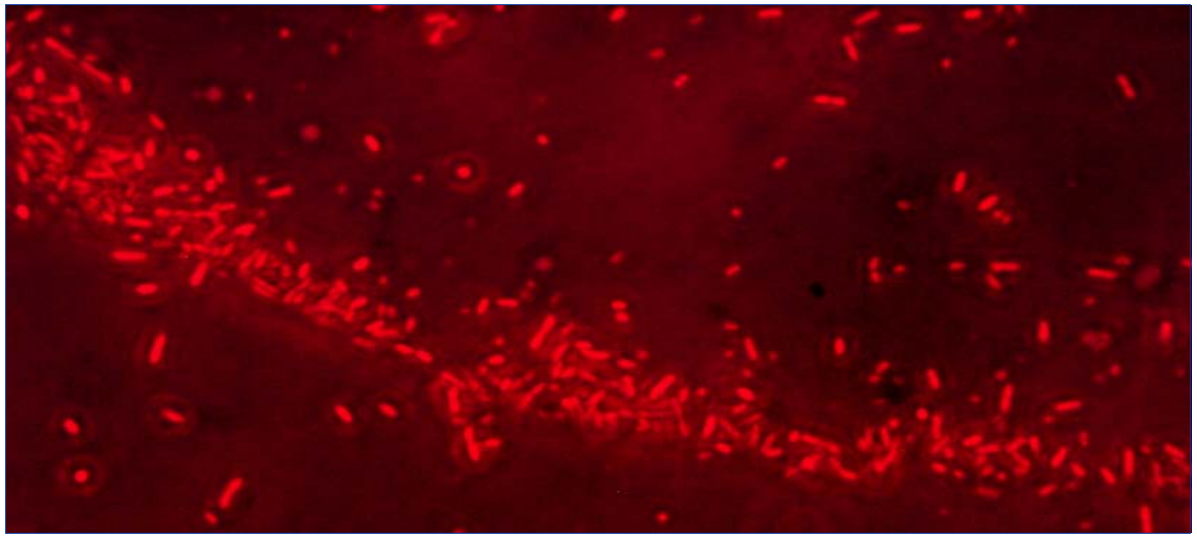
- **Watershed Level Water Quality Management**
  - —San Joaquin River Basin
- **Non-Point Source Pollution**
  - —Total Maximum Daily or Monthly Load Development
  - —Modeling and Analysis for Pollutant Transport and Total Maximum Daily Loads
- **Real-Time Technology & Control**
  - —Real-Time Management of TMDL & TMML
- **Technology Development**
  - —Biological Treatment
  - —Advanced Monitoring Techniques

Water Conservation & Use Efficiency

- **Domestic/Commercial**
  - **Impacts of California drought**
  - **Efficient clothes washers, plumbing fittings and fixtures**
- **Industry**
  - **China Motor System Energy Conservation Program, providing training to Chinese engineers and case study development support**
  - **Energy- and water-efficiency technologies and measures for industries**
  - **Partnering with Hydraulic Institute (pump manufacturers association) on multiple projects**

Water Disaster & Security

- **Vulnerability Assessment of Supply, Ecological Resources and Rural Economy due to Climate Variability and Extreme Weather Events**
- **Advanced Biological Treatment for Drinking Water Protection**



LBNL Capabilities

Technology Assessment

- Benchmarks
- Engineering design of alternatives
- Market assessments

Supply and Demand Integration

- Disaggregated demand analysis
- Conservation supply curves
- Real-time watershed water quality forecasting and management
- Climate change impact studies and hydroclimate forecasting

Economic Evaluation

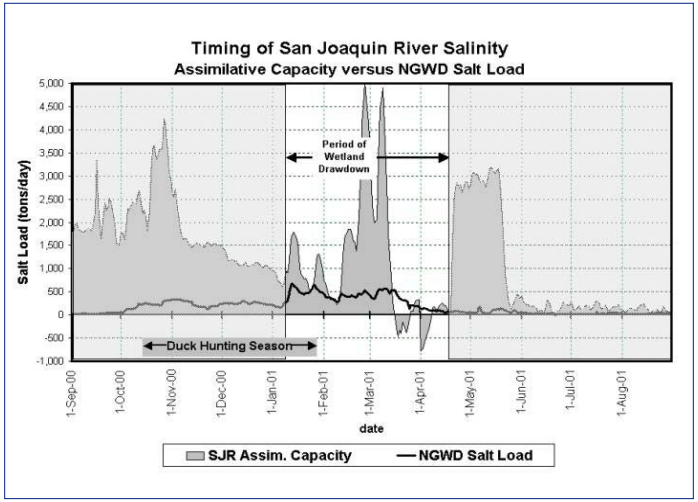
- Life-cycle cost alternative technologies
- National energy and economic impacts
- Environmental assessment
- Risk and uncertainty analysis

Technology Development & Application

- Characterize water resources
- Model and simulate
- Monitor (sensors and telemetry)
- Treat water and wastewater
- Site remediation

Examples of LBNL Projects and Partners (1)

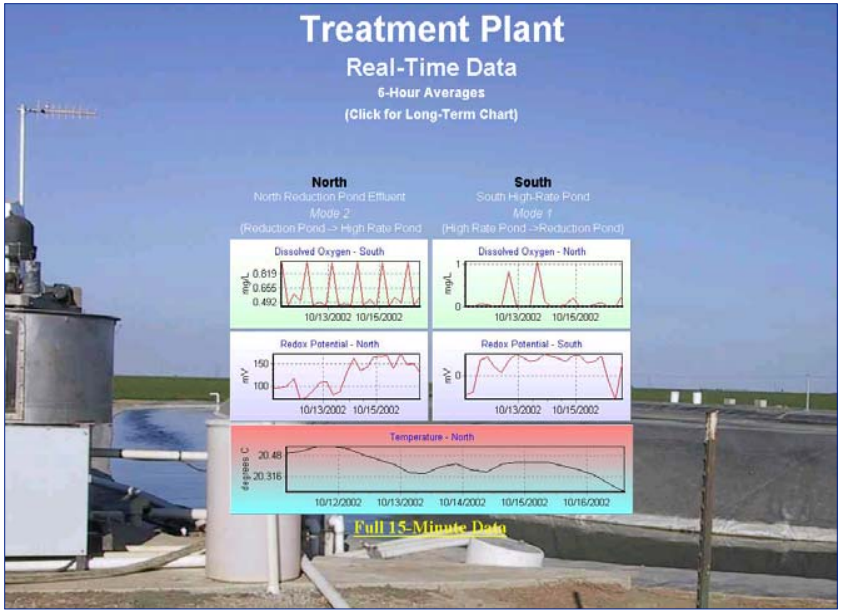
- **Agriculture**
  - **Real-time water quality forecasting management in the San Joaquin Basin**
    - **(US Bureau of Reclamation, CALFED, Department of Water Resources)**



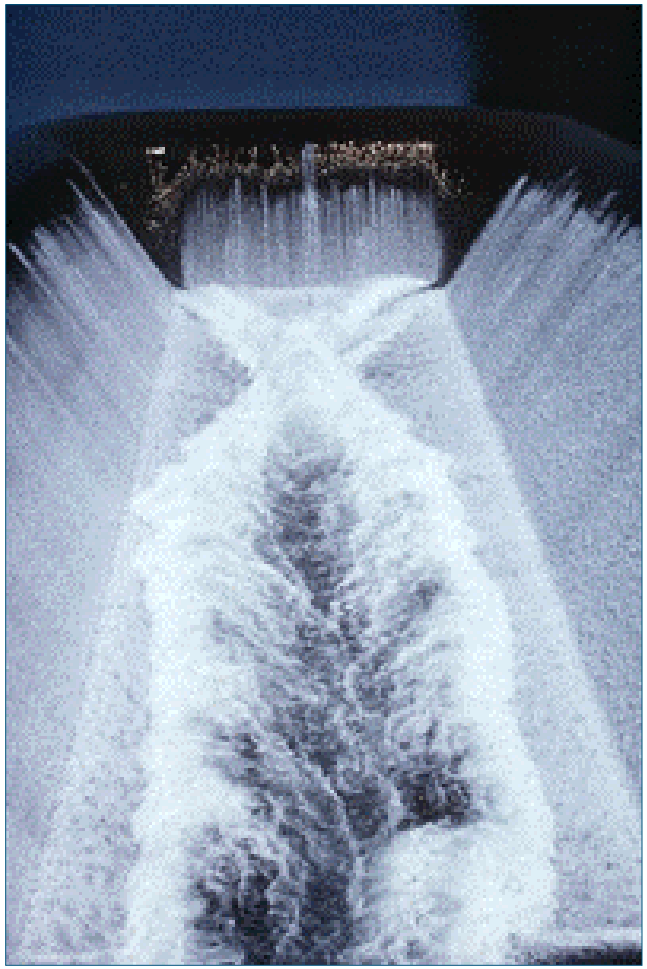
  - **Real-time salt management from seasonal wetlands**
    - **(Grassland Water District, San Luis National Wildlife Refuge, CALFED)**
  - **Algal bacterial selenium removal from agricultural drainage**
    - **(CALFED, US Bureau of reclamation, Panoche Water District, DWR)**

Examples of LBNL Projects and Partners (2)

- **Agriculture (continued)**
  - **Algae fate and transport in the San Joaquin River monitoring and modeling**
    - (CALFED, San Joaquin River Group, Westside Area Farmers)
  - **Regional groundwater conjunctive use modeling and planning**
    - (US Bureau of Reclamation, DWR)
  - **Hydroclimate, water resources, and agro-economics using remote sensing data and models, Southwest US, East Asia**
    - (NASA/IDS, NASA/RESAC)



Examples of LBNL Projects and Partners (3)



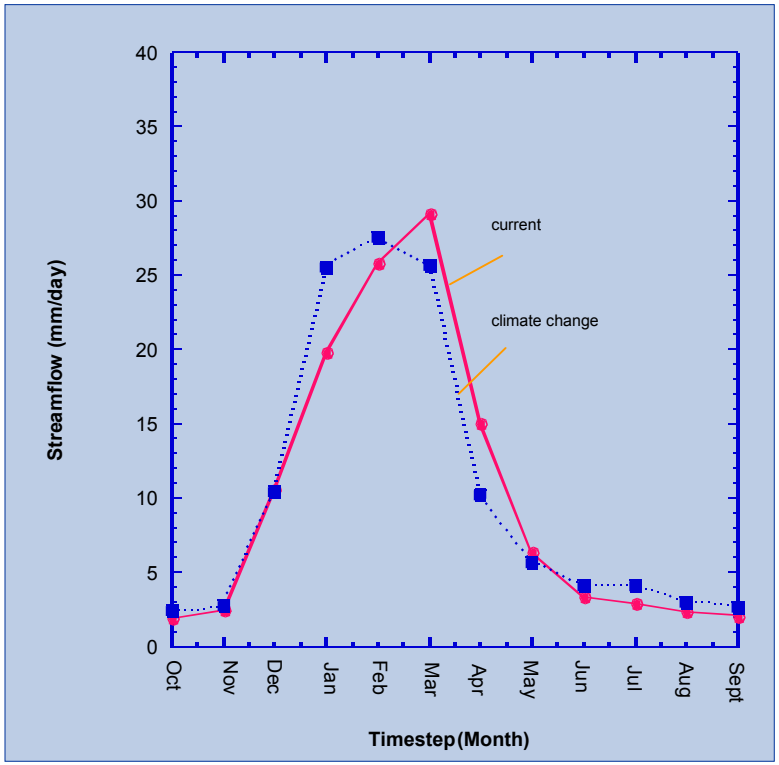
- **Industry**
  - —**Partnering with Hydraulic Institute (pump manufacturers association) on multiple projects**
    - developing a curriculum for pumping system optimization workshop
    - developing pumping system optimization video training
    - collaborating on Pumping System Life Cycle Cost Guide
    - recent formation of HI Market Transformation Committee
    - (DOE/IT)
- **Water Allocation Model**
    - (EPA/STAR)

Examples of LBNL Projects and Partners (4)

- **UV Waterworks**
  - —Rapid, effective, low cost, low maintenance, and energy efficient means of disinfecting water in rural areas
- **Domestic/Commercial**
  - —Impacts of California drought
    - (State of California)
  - —Efficient clothes washers, plumbing fittings and fixtures
    - (DOE/EERE/BT)

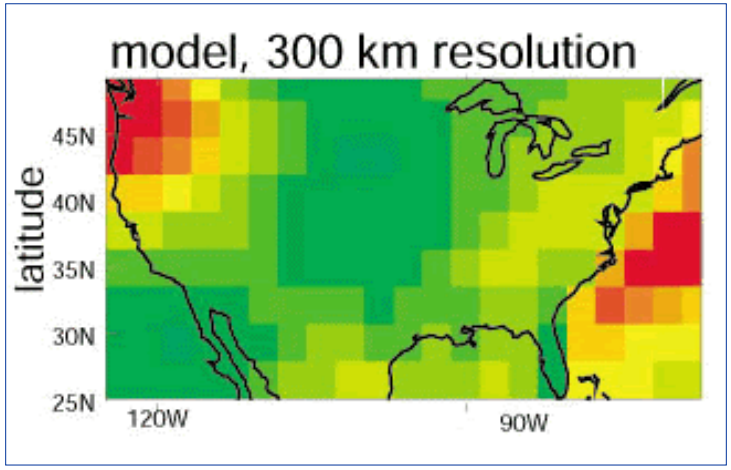
Examples of LBNL Projects and Partners (5)

- California Water Resources Research and Applications Center, NASA/RESAC
- Modeling and Analysis of the Hydrologic Cycle : Seasonal and Event Variability at the Walnut Watershed, DOE/BER
- Dominguez Channel Modeling and Analysis for Pollutant Transport and Total Maximum Daily Loads, DOE/FE/NETL
- Vulnerability Assessment of San Joaquin Basin Water Supply, Ecological Resources and Rural Economy due to Climate Variability and Extreme Weather Events, EPA/STAR



Climate Change River Projections

New Opportunities



REGIONAL CLIMATE SYSTEM MODEL: Coupled end-to-end (atmosphere-land surface-streamflow-contaminant) system model assesses basin-wide effects of climate/extreme events on water supply, ecology and rural economy.

- **SUPPLY/DEMAND INTEGRATION: Compare costs of conservation measures to new supply.**

- **WASTEWATER TREATMENT: Compare life cycle costs of alternatives.**

New Opportunities (continued)

- **INDUSTRY: Technology assessments, water and energy benchmarks for industries through an evaluation of actual processes**
- **DOMESTIC/COMMERCIAL: Characterize end-use demands by adding questions to Residential Energy Consumption Survey (RECS) and Commercial Buildings Energy Consumption Survey (CBECS)**
- **CHINA WATER CONSERVATION: Urban and industrial water use benchmarking and conservation policy analysis (Tsinghua Univ., Beijing Municipality, etc.)**

  Energy- and water-efficiency technologies and measures for industries

- **AGRICULTURE: integrated basin water resource planning and management using innovative metrics and optimization criteria**

For more information

- **LBNL Websites:**
  - esd.lbl.gov (Earth Sciences Division)
  - eetd.lbl.gov (Environmental Energy Technologies Division)
  - Water Energy Technologies Team

    http://Water-energy.LBL.gov
  - HEADS (HydroEcological Engineering Advanced Decision Support)

    http://www-esd.lbl.gov/ECO/HEADS/index.html
  - Water Resources Research & Applications Center

    http://www-esd.lbl.gov/RCC

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